A Fresh SPURS

Friday Discussion

Science Questions

How does a fresh water source differ from a salt source? (buoyancy → mixing….)

Fresh water capping issues:

Shallow rain events (meters / days)

1. Seasonal Barrier Layers (10s of meters / months)
2. Permanent Barrier Layers
    1. Rain formed (ITCZ..
    2. River formed (Amazon, BoB)

Fresh water capping (cont)

- Vertical structure
  1. Wind mixing
  2. Thermal inversion
  3. Double-diffusion
  4. Internal waves
  5. Solar absorption profile (river water vs ocean)
  6. SST response to fluxes
  7. Feed back on climate (Hurricanes (Mc Phaden et al 2012), monsoons, ENSO….)

Lukas and Lindstrom, 1991

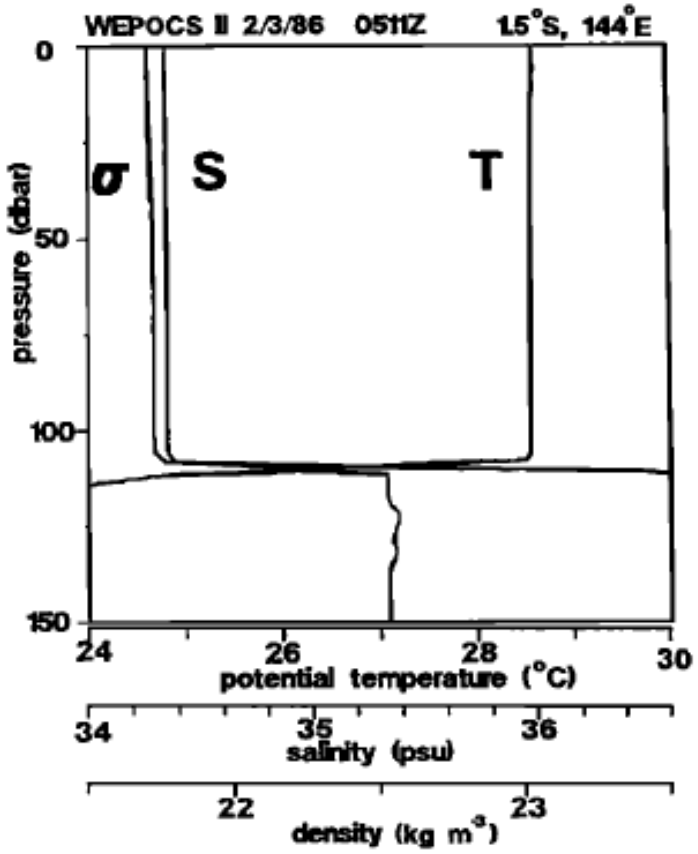


Fig. 2. Potential temperature, salinity, and potential density from a CTD profile at 1.5°S, 144°E in February 1986.

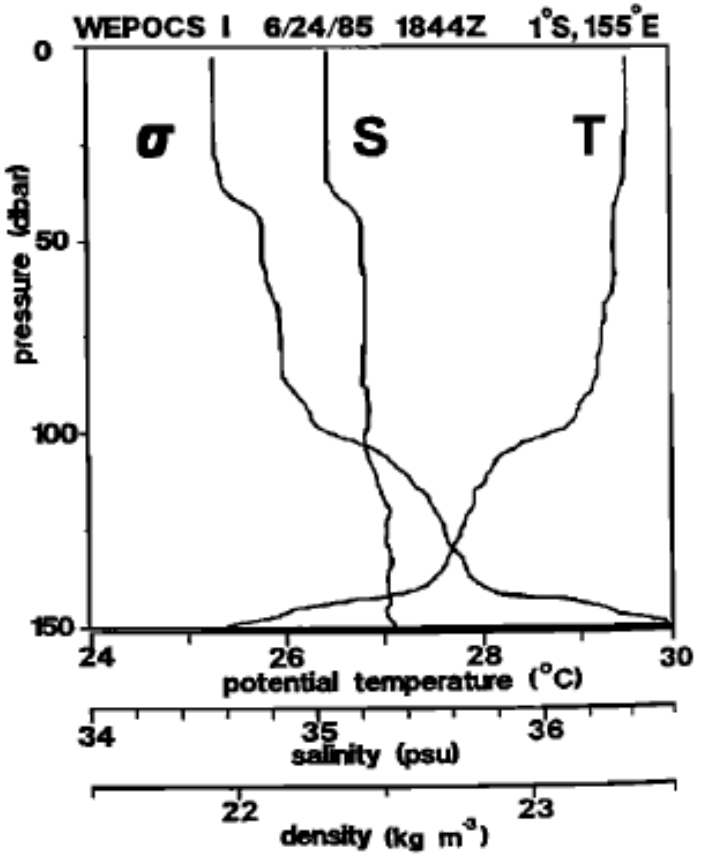


Fig. 3. Potential temperature, salinity, and potential density from a CTD profile at 1°S, 155°E in June 1985.

Price, 1979. Observations of a rain-formed mixed layer

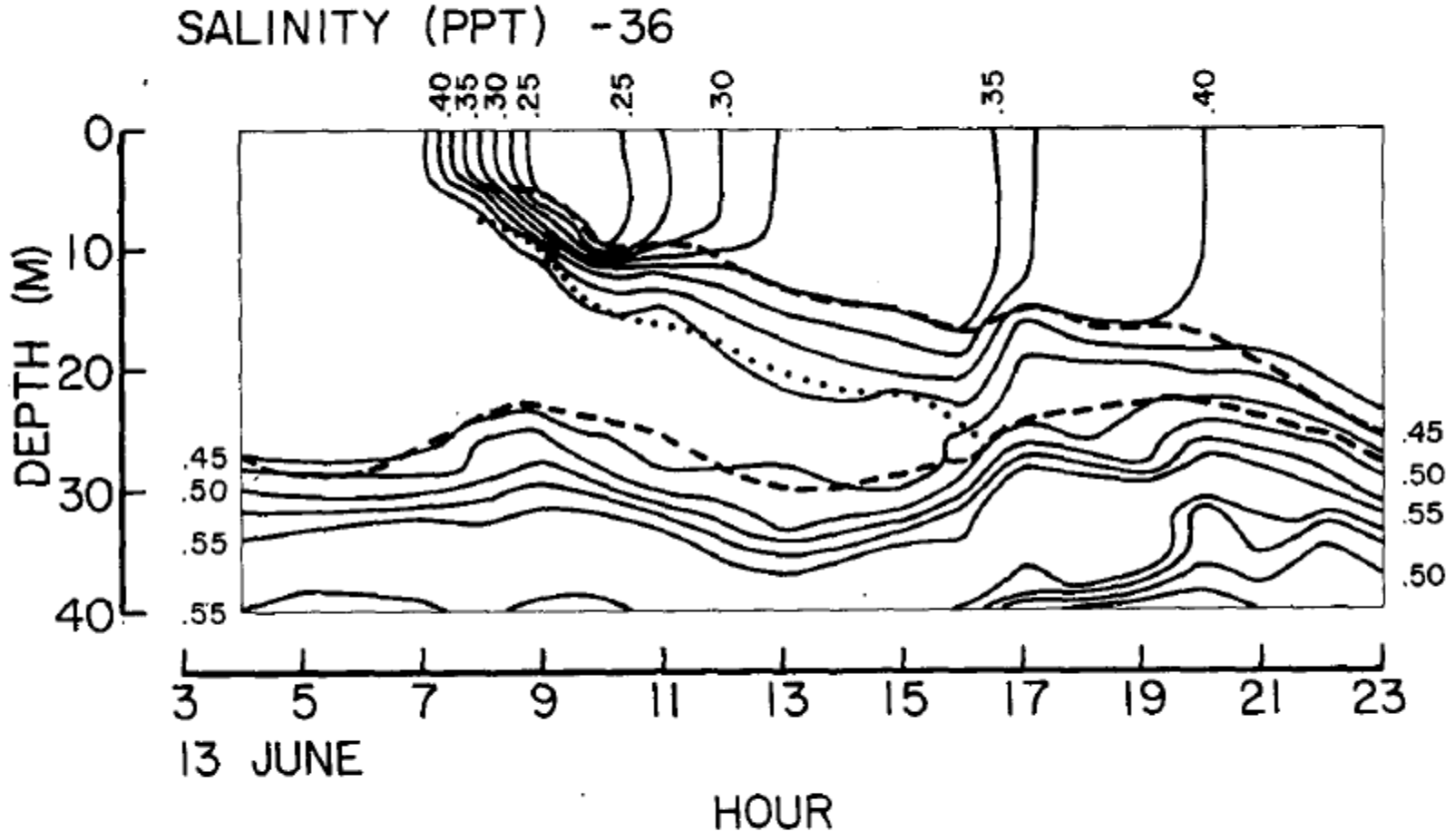
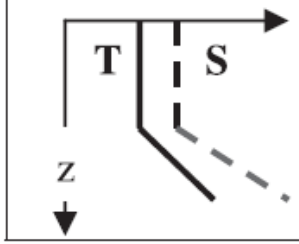
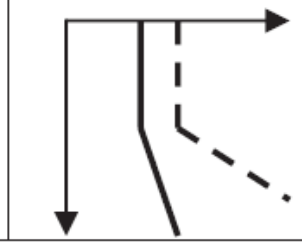
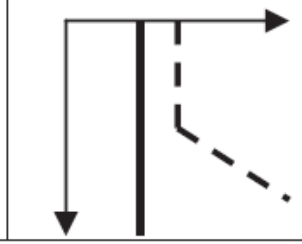
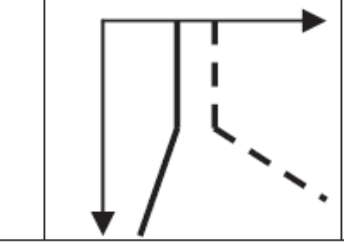
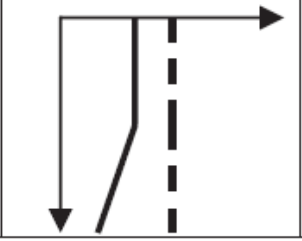
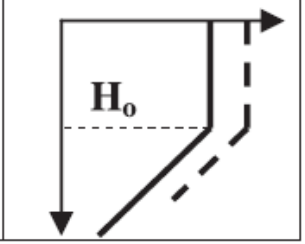


TABLE 1. Bulk Turner angle and idealized vertical profiles of temperature and salinity corresponding to CL and BL; $T_z = \partial T/\partial z < 0$ implies stable stratification (z-axis is downward), and H_0 is isothermal or isohaline layer depth (whichever is shallower).

CL	**BL**				**CL**
Bulk Turner angle					
-90° $\tan^{-1}(-3)$	$\tan^{-1}(-3)$ - 45°	-45°	-45° 45°	45°	45° 90°
Vertical T-(solid) and S-(dashed) profiles					
					

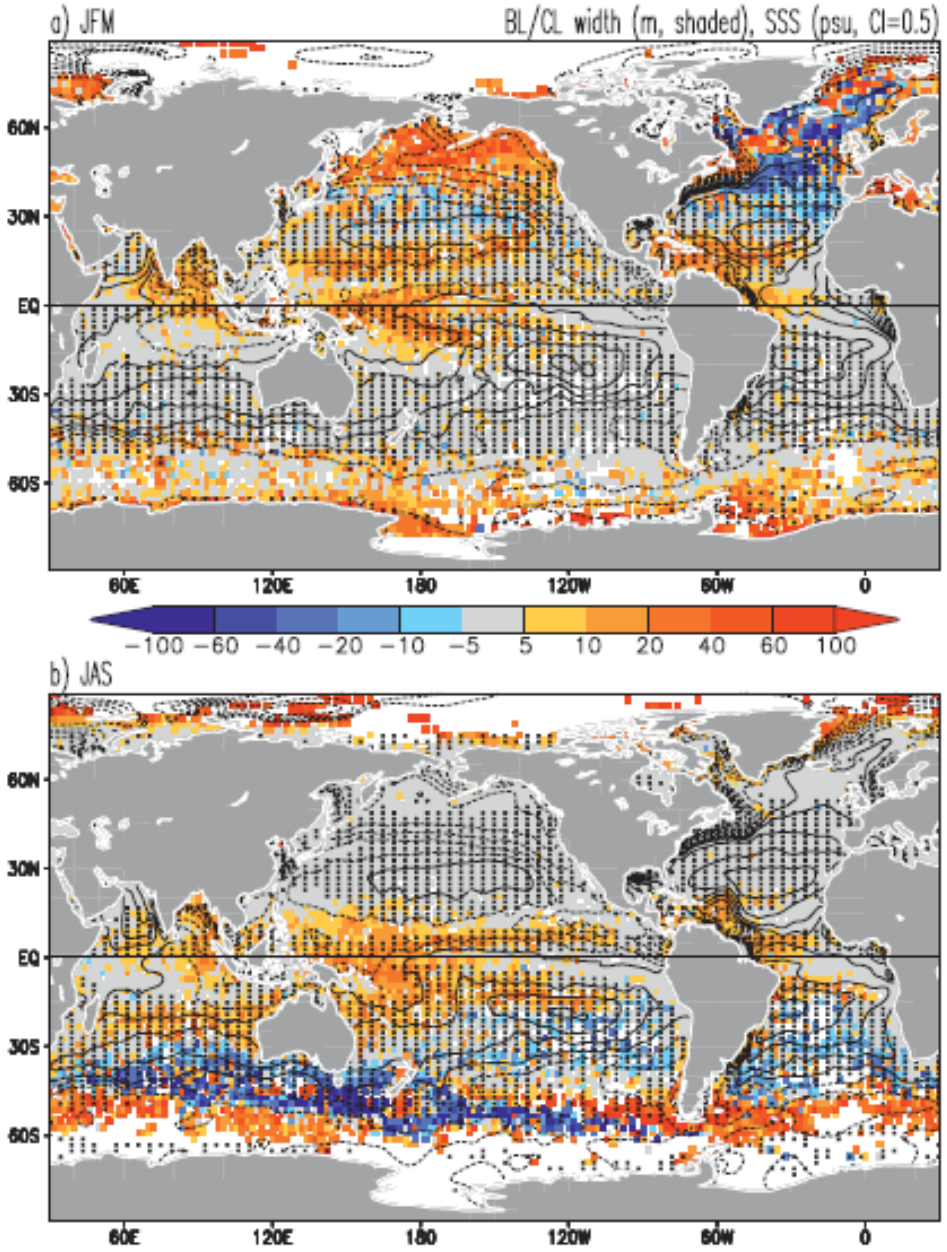


FIG. 2. Observed climatological (a) January–March and (b) July–September barrier-layer width (positive) and compensated-layer width (negative): climatological SSS (Boyer et al. 2006; contours), SSS ≥ 35 psu (solid), and SSS < 35 psu (dashed). Areas of downward Ekman pumping are crosshatched. Ekman pumping is evaluated from the QuikSCAT scatterometer winds of Liu (2002).

Fresh water capping (cont)

- Horizontal structure
  1. Fronts
  2. Currents
  3. Eddies and instabilities
  4. Submesoscale instabilities
  5. Patchiness of rain
  6. Barotropic/baroclinic responses to rain events
  7. Mean barotropic/baroclinic responses to net FW flux
  8. Internal waves

Seawifs imagery of Amazon Plume (CDOM).

Profiling floats show high correlation of CDOM with SSS

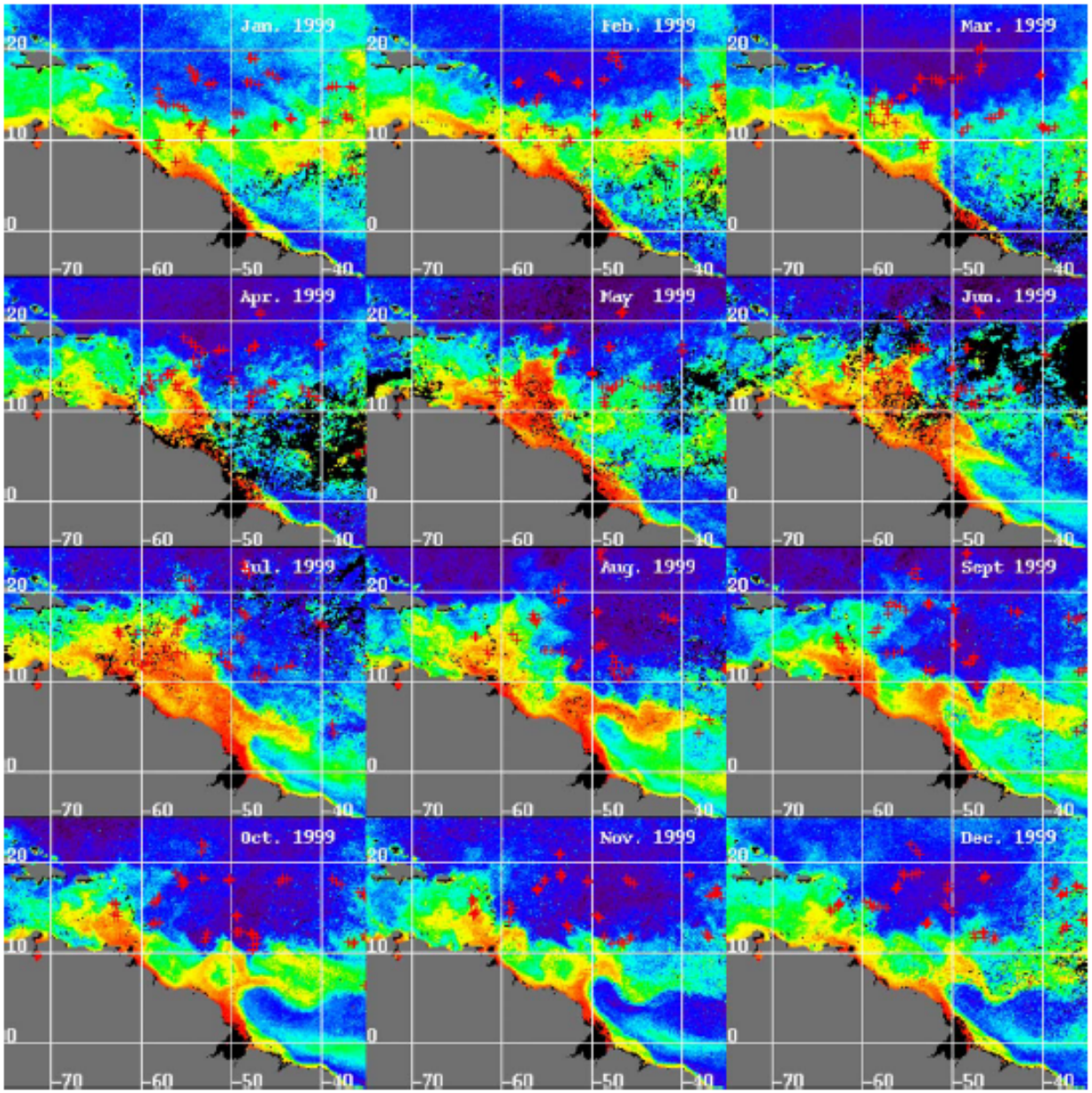
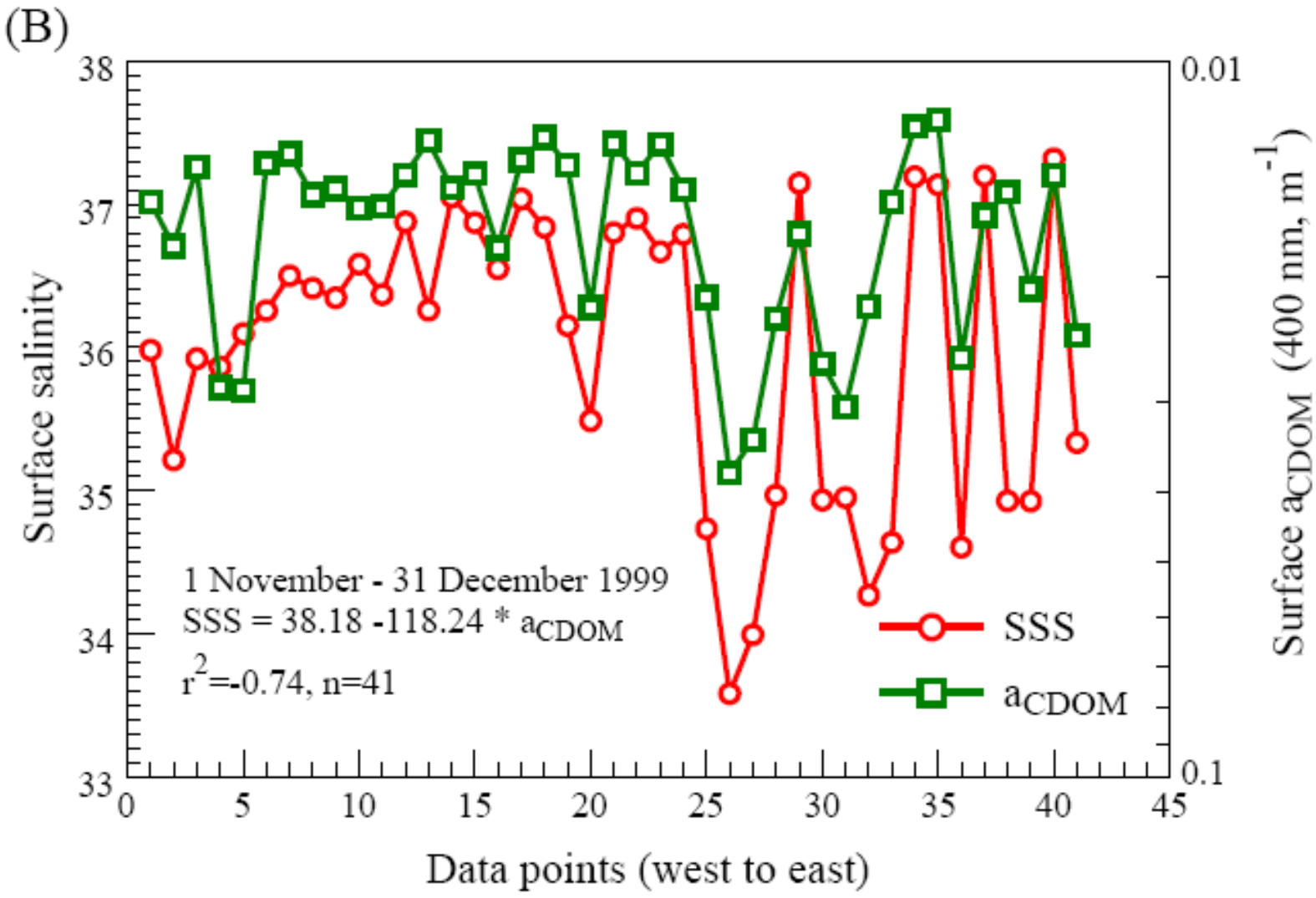


Fig. 2. (*Continued*)

SSS-CDOM are correlated

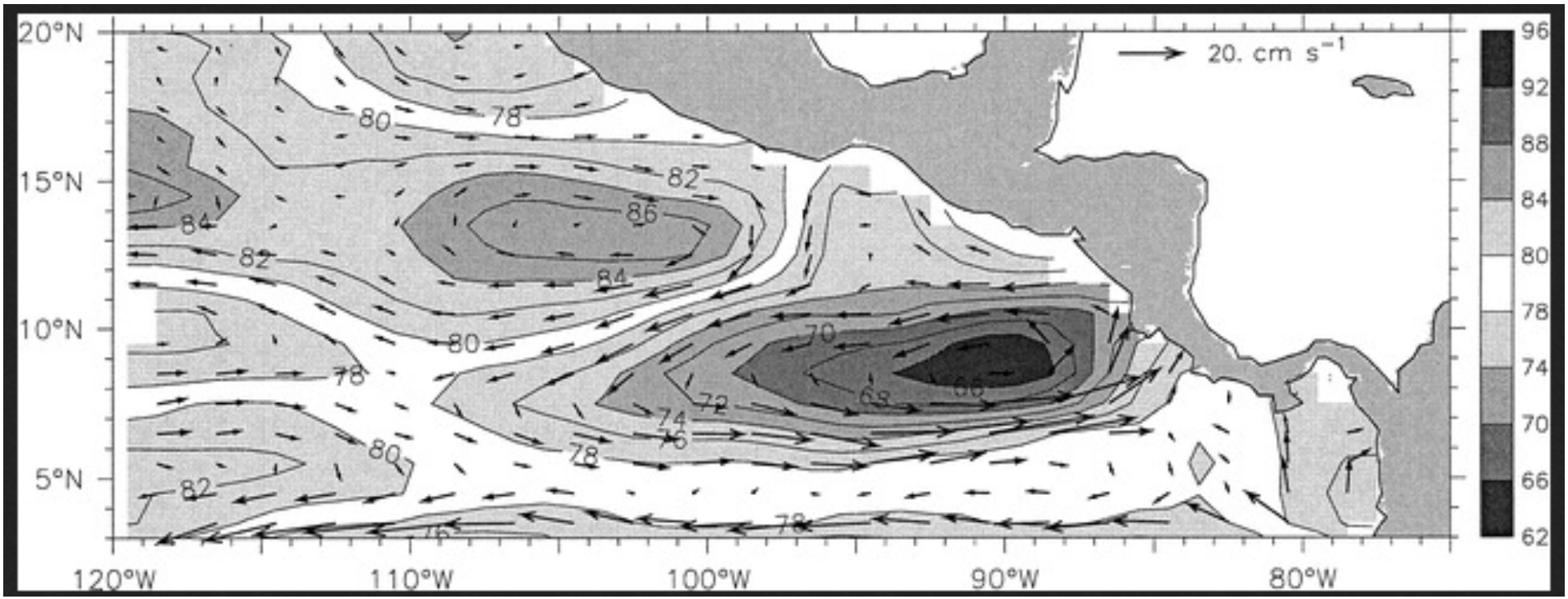


What can we learn?

- Space scales and structure of rain patches
  - Ships radar
  - CT Sensor fin on a small boat at 20 knots??

- Impact on vertical mixing
- Horizontal dispersion and mixing processes
- Frontal instabilities

Costa Rican Dome
Kessler 2002



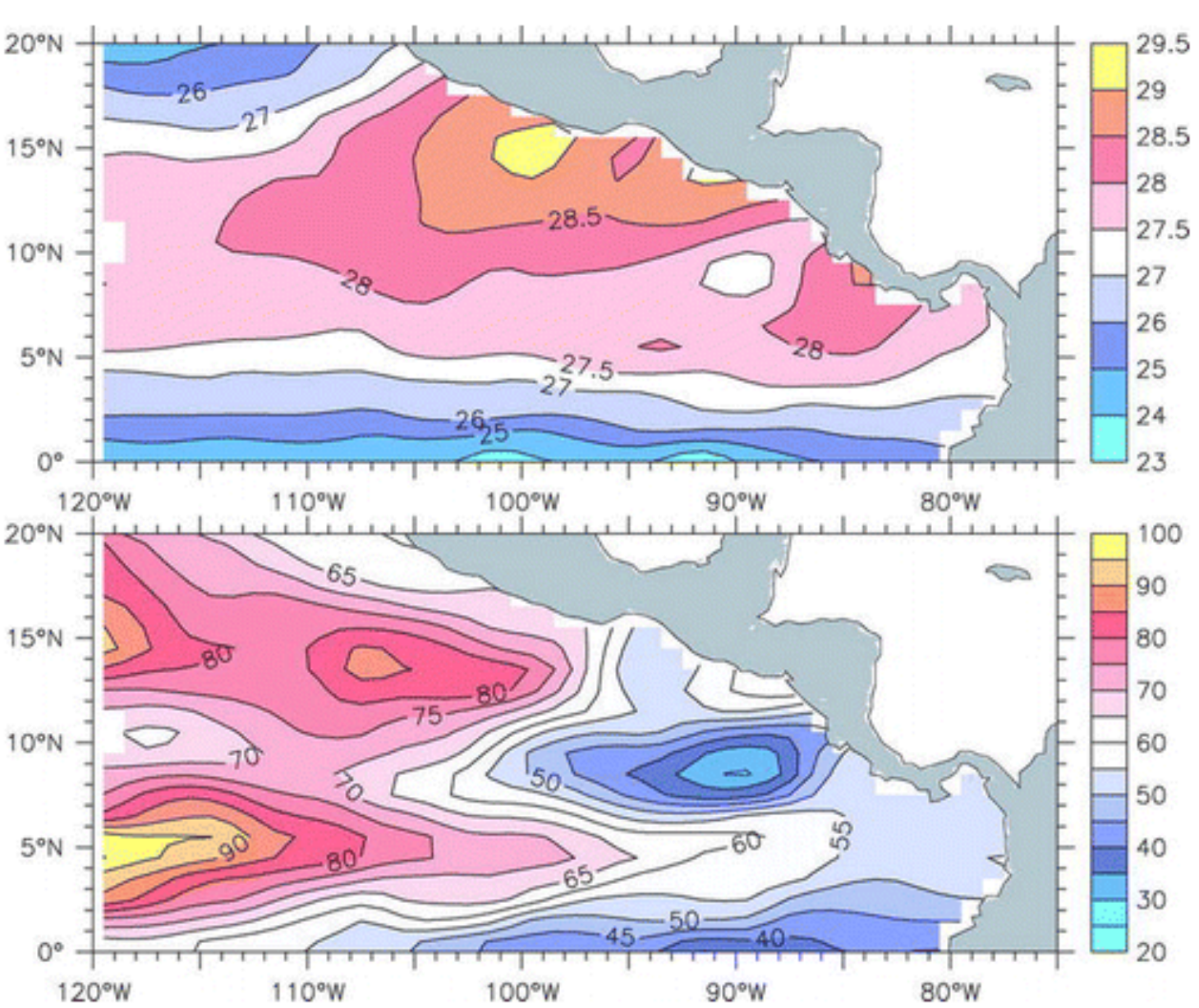


FIG. 2. Mean SST (top) and 20°C isotherm depth (Z20; bottom) from the XBT data. The contour interval for SST is 1°C, with supplementary contours at 27.5° and 28.5°C. Red shading indicates warm SST, blue cool. The contour interval for Z20 is 5 m. Red shading indicates deep thermocline; blue, shallow

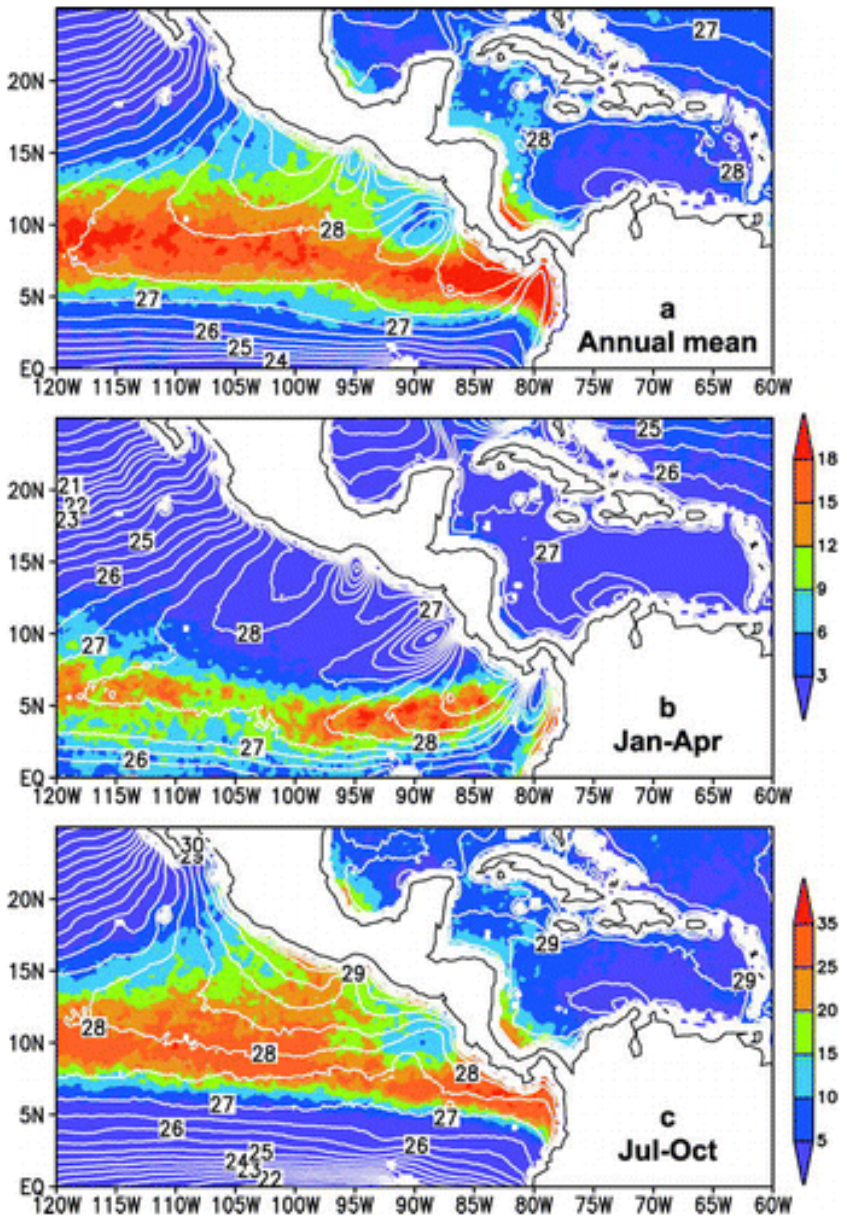


FIG. 8. TMI SST (contours; °C) and precipitation (shade; mm day^{-1}) climatology: (a) annual mean, (b) Jan–Apr, and (c) Jul–Oct. In (c), note the different color scale for summer

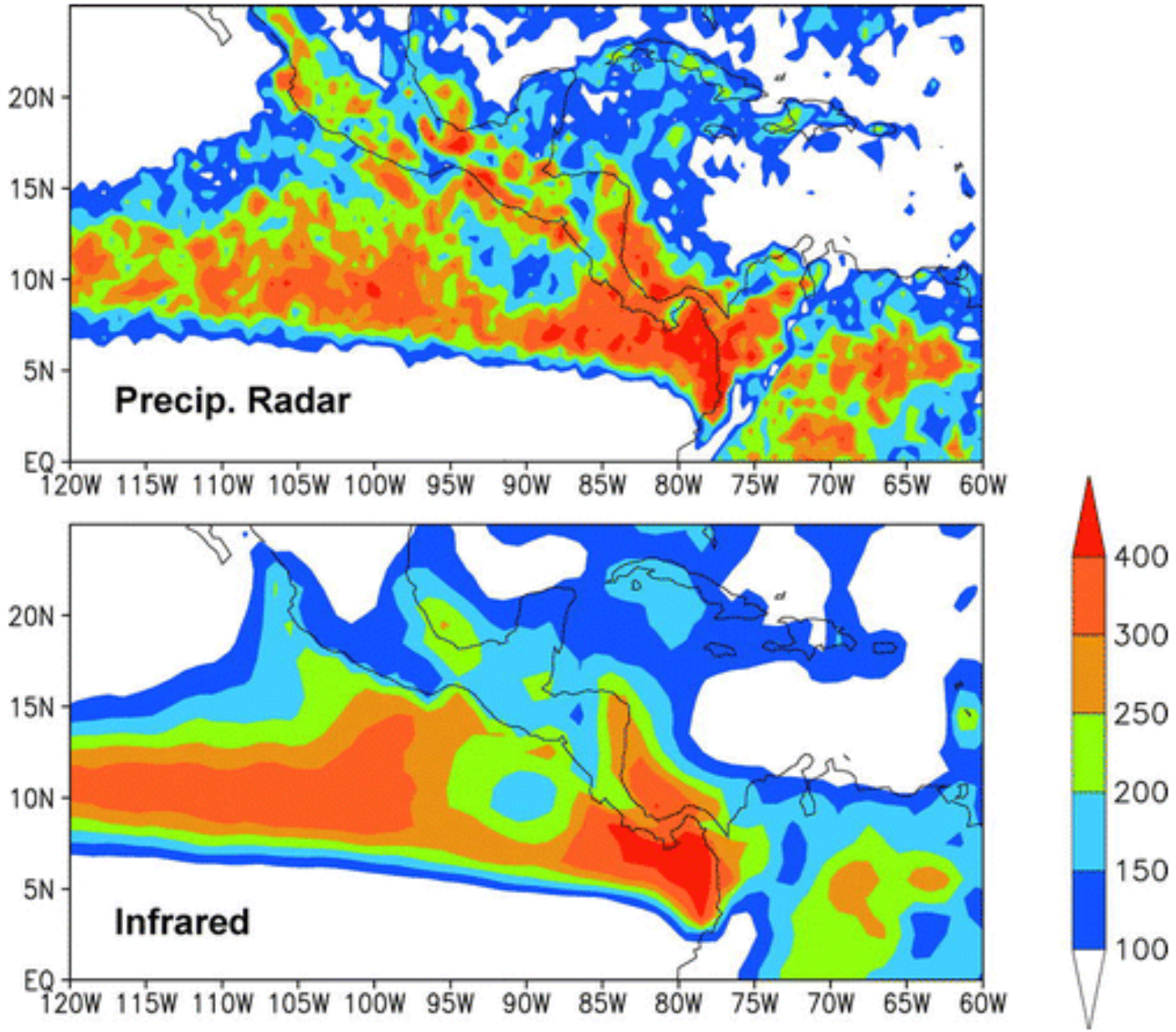


FIG. 10. Jul–Oct precipitation (mm month^{-1}) based on the (top) TRMM PR (3A25G2) and (bottom) infrared (3B43) measurements